

CHAPTER 5. MILITARY RADIOLOGY FUNCTIONAL ECONOMIC ANALYSIS

5-1. INTRODUCTION

a. The future of military healthcare will be characterized by access to high-quality care at anytime, anywhere, with total integration of patient records to the healthcare process. These requirements have brought to the forefront the limitations of the delivery of radiology services. Availability and accountability of diagnostic images are hindered by single access to images and by manual storage. Military readiness is impeded by the lack of timely interpretations in the field and the constraints of a chemicals-based system. Access to care may also be restricted by the limited availability of radiologists, especially in remote locations.

b. Along with these limitations, several external forces are affecting delivery of radiology services. Increased regulatory oversight, TRICARE competition, managed care, and the right-sizing of the DOD are just a few of the forces constraining radiology resources and altering healthcare delivery practices. The strategic direction of the MHS, the external forces influencing healthcare delivery, the limitations of film-based radiology, and the emergence of innovative technologies are all compelling reasons for change and contribute to the motivation behind this business process reengineering effort. At the time that it was published, The *FEA (BPR1255047-035*, September 4, 1996) represented the vision of the military radiology community and effectively prepared DOD radiology services to meet the needs of MHS beneficiaries in the most effective and timely manner possible. This document is still the most comprehensive analysis for Military Radiology. The TARA program works closely with the OTSG Clinical Consultants to ensure that this information is still relevant for and applicable to our mission.

5-2. GOALS OF MILITARY RADIOLOGY

a. The goal of military radiology is to be the premier provider of top-quality radiology services to all DOD health beneficiaries in any situation or environment. To attain this goal, a radiology work group developed several objectives and performance measures. Although these objectives and measures encompass the cost, quality, access, and readiness of radiology services, a primary emphasis was placed on satisfying the customers, including patients, clinicians who request radiology services, and line Commanders of the radiology department.

b. To successfully attain the objectives and meet performance measures, the work group defined several changes to the process and scope of radiology services. To improve image file availability and accountability and provider productivity, radiology must implement efficient image management by automating image storage and retrieval. To reduce wait times, eliminate unread exams, and improve provider satisfaction, military radiologists intend to provide "real-time" radiology services. Instead of the days or weeks that often elapse between a physician's request and the transcribed diagnosis, radiology will provide immediate responses to all exam requests. A tri-service radiology department will improve radiologist productivity and education through the redistribution of its workload within and among Tri-care regions, thereby enabling greater access to quality services. This capability will also enable 24-hour on-line availability of radiology services to deployed forces. Decentralized radiology departments will improve responsiveness and consultative services as radiologists are physically relocated to specific high-volume clinical locations. Similarly, centers of excellence will be developed to increase the use and

effectiveness of consultations and second opinions. The result will be improved diagnostic accuracy leading to better patient care.

5-3. GOALS OF DIGITAL RADIOLOGY

a. To implement these improvements and others as well, digital radiology must become a reality. These improvements require immediate and simultaneous access to any image by those authorized to view and interpret diagnostic images. A PACS will facilitate acquisition, storage, and distribution of radiology images in a digital format. Teleradiology will enable this image management to take place among facilities, regions, and international boundaries.

b. The implementation of PACS and teleradiology will facilitate the real-time and simultaneous access to images by radiologists and providers. Unfortunately, radiology images represent only half of the equation. Adequate modality upgrades to meet digital requirements and DICOM conformance will provide a seamless interface between the modality and PACS. Transcribed reports must accompany each examination result. Voice recognition dictation systems will eliminate transcription backlogs as providers are enabled to dictate and verify reports without delay. In addition, enhanced telecommunication lines must be installed prior to implementation of teleradiology. The simultaneous and immediate availability of radiology images and reports will greatly enhance radiology services.

5-4. BUSINESS PROCESS IMPROVEMENTS FOR MILITARY RADIOLOGY

a. To facilitate the recommended business process improvements and the transition of military radiology to a digital environment, MTFs should work with the TARA team. The USAMMA TARA team and the APPMO will ensure Army uniformity by providing guidance and consultation to Army hospitals before and during the implementation of digital technologies. Although radiology is the primary generator of diagnostic images, PACS could also be implemented to support other diagnostic imaging specialties (e.g., cardiology or dentistry). The archival and distribution requirements should not differ among diagnostic specialties. The TARA team will ensure that, before any equipment is installed at a site, the business process changes and expected benefits are clearly understood and accepted by the site personnel.

b. The radiology work group recommends several other business process improvements. These include new and modified radiology activities and extensions beyond the scope of the FEA. Of primary importance are the following items:

(1) The monitoring of performance, business trends, and clinical practices. This function of monitoring performance, business trends, and clinical practices can be best facilitated by the TARA program;

(2) The establishment of working relationships with non-DOD federal agencies;

(3) The retention of military radiologists; and

(4) Standardization of the use of the CPT coding system.

c. Two alternatives were defined to accomplish the recommended business process improvements.

(1) Continuation of analog, film-based radiology services. This alternative is based on the standard staffing requirements needed to meet current workload levels. Currently, there is a shortage of military radiologists. As a result of negative feedback and the unlikely prospect of increased staffing during military downsizing, this alternative was deemed unfeasible.

(2) Transition to digital radiology. This alternative enables the recommended business process improvements through the technologies previously discussed. The primary cost drivers of this alternative are PACS, teleradiology, telecommunications infrastructure, and voice recognition equipment. The anticipated monetary benefits estimated for this alternative include reductions in the costs for film, chemical purchase and disposal, file room clerks, and transcription services. Other monetary benefits could be realized in reductions in the costs associated with medical evacuations, file rooms, darkrooms, chemical capture devices, malpractice suits, and contract radiologists.

5-5. DIGITAL TECHNOLOGY

a. The radiology work group unanimously agreed that the transition from film-based, analog systems to digital data acquisition, storage, transfer, and interpretation is necessary to maintain an edge in the readiness of our military forces and to improve the quality of services provided to radiology customers. The DOD-developed Medical Diagnostic Imaging Support (MDIS) system was the first tool used to accomplish this functionality. At the time of this functional analysis, the consensus of the radiology work group was that the commercial market for similar digital technologies was maturing. The group recommended that, although the DOD should continue to support installed MDIS systems and other current obligations, it should also seek less expensive solutions that used integrate, scaleable commercial-off-the-shelf (COTS) packages. The solution for digital imaging storage and distribution was the DIN-PACS contract awarded to Agfa and IBM. Modality compatibility with DIN-PACS is provided through compliance with the DICOM standards (see chapter 6). The successor to the DIN-PACS contract has been written to broaden the choice of vendors and was awarded in mid 2004.

b. The recommended functional improvements enabled by digital radiology will strengthen the MHS push towards attaining designation as the benchmark healthcare delivery system. The unified front presented here will enhance the joint medical readiness capabilities of the MHS. The digital transformation of radiology will enable the seamless integration of healthcare technology and the patients' records. The military radiology community is unified in commitment to the fulfillment of the recommendations that lie within this document.

5-6. RADIOLOGY PERFORMANCE MEASURES AND TARGETS

a. Performance measures are quantifiable indicators used to evaluate the effect of changes on functional processes. Managers typically use performance measures to gauge the amount, speed, quality, and cost of work done by an activity or function. These measures must be meaningful to the functional managers responsible for the activity. Furthermore, they must serve as indicators of the short-term impact of the business process changes and long-term contributions to the strategic direction of the MHS.

b. Sections 1 and 2 of *FEA* outline the goals of the MHS and the functional area of radiology. The radiology work group selected several performance measures that could be used to measure the degree of success in attaining those goals. Table 5-1 lists these

performance measures, the means of capturing data for these measures, the current levels of performance, and a 6- to 10-year target. Local managers should use these and other performance measures to steer change within their organization.

c. The *FEA* cited a survey sent in April 1996 to 102 of the radiology sites. Responses to this survey were used to establish a baseline for several performance measures. Seventy sites returned the surveys. The mean, standard deviation, and confidence interval were computed for each radiology site type. The averages referred to throughout the remainder are for all responding radiology sites.

d. Several performance measures can be used as proxies for satisfaction, but unless critical stakeholders are specifically asked, it is difficult to know whether they are satisfied. On the basis of a telephone survey to 12 randomly selected Army, Navy, and Air Force facilities, it is estimated that only about 47 percent of military radiology departments use provider-satisfaction surveys. The work group set as a target that all radiology departments survey a random sample of providers and patients to measure the performance of the department and to identify opportunities for improvement. The work group has developed satisfaction surveys for both providers and patients that can be used by radiology departments. These or other surveys can be tailored to site-specific needs. Once baselines are established for the surveys, results should be compared from year to year, taking appropriate actions if a degradation in performance is recognized.

Table 5-1. PERFORMANCE MEASURES

Performance Measure	Source of Data	Current Performance Level	6- to 10-Year Target
Provider and customer satisfaction	Telephone survey	47% of radiology depts. utilize provider surveys; 94% of radiology depts. utilize customer surveys	100% use for each
Standards compliance	Telephone survey	53% use ACR standards; 47% use ACR appropriateness criteria	100% awareness and use
Cost per RVU	MEPRS Central (June 1995)	Average an 8.6% increase per year over the past 6 years.	Do not exceed rate of medical inflation
Diagnostic accuracy	Department of Legal Medicine	\$24.1M in diagnosis-related claims since 1990; \$3.86M due to a delay in diagnosis	Eliminate claims attributable to a delay in diagnosis; cut all others in half
RVUs/Radiologist (proxy raw procedures) ¹	DMIS-SS MEPRS Central (June 1995) JHMET	14,815 raw procedures non-GME; 8,803 at GME locations	12,316 raw procedures at non-GME sites; 7,919 at GME locations
Technologists and support per radiologist ¹	DMIS-SS (June 1995) Survey	5.3 to 6.4 technologists and support personnel per radiologist	4.5 technologists and support personnel per radiologists
Report turnaround ¹	Survey	2.5 days	One hour
Image file availability and accountability ¹	Survey	7.3% unavailable 2.9% unaccountable ²	99.9% availability and accountability
appointment wait time (days to available appointment)	CHCS	X-ray: 1 Mammo: 13 US: 10 Nuc Med: 4 CT: 6 Special: 6 MRI: 12 Angio/Inter: 3	Competitive with wait times at civilian facilities
Unread examinations ¹	CHCS	Approximately 4.4% of exams are never read at 2 months ²	All exams to be read
Fetch time ¹	Expert opinion	2-20 minutes per search depending on location ²	2 to 3 seconds per retrieval
Radiation exposure	Digital equipment will measure	Not captured	Decrease by the reduction in repeat films
Technical repeats ¹	CHCS	4.3% ²	<1%
Medical evacuations (MEDEVAC)	Bosnia data	Not available	Eliminate med evacs for radiological reasons

Acronyms:

ACR, American College of Radiology
CHCS, Composite Healthcare System;
DMIS-SS, Defense Medical Information System-Summary System
GME, Graduate Medical Education
JHMET, Joint Healthcare Management Engineering Team
MEPRS, Medical Expense Performance Reporting System
RVU, Relative Value Unit

¹Data are for film-based performance and do not represent performance levels at PACS sites.

²These baseline measures are all significantly higher when accounting solely for larger radiology sites where the greatest number of procedures is performed.

e. Sites were surveyed randomly to determine the extent of the use of ACR standards and appropriateness criteria as department guidelines. ACR standards define specific guidelines such as radiation dose, personnel qualifications, and equipment specifications required for proper execution of radiology procedures. ACR appropriateness criteria specify the indications that substantiate the need for a radiological study. Both of these are designed to improve the quality and utilization of radiology services. The work group set as a target that every radiology department maintain a current copy of these guidelines, study their contents, and apply them as standards within the department.

f. From the MEPRS central database, the work group extracted radiology cost and workload data from 1990 to 1995. Data was pulled for the diagnostic radiology and nuclear medicine accounts. This measure includes all direct and indirect costs divided by total weighted workload reported in MEPRS. Through the course of this 6-year reporting period, workload reporting has changed. After 1993, the relative value scale was adjusted, thereby greatly increasing the number of RVUs for a given set of procedures. Because of this, the group chose to analyze the trend of cost per RVU from 1990 to 1993 and again from 1994 to 1995. Through the course of these years, the cost per RVU has averaged an 8.6 percent increase per year. The radiology work group believes that the increase in this performance measure should not exceed the rate of medical inflation. In the past this rate has exceeded 10 percent; current projections indicate a 5 percent rate in the short-term future. Yearly MEPRS data can be used at the local, service, and DOD levels to measure success in attaining this performance measure. For this metric to be meaningful, reporting must be accurate and consistent between years. Therefore, 1996 should be used as the baseline, since CPT coding has been assumed as the workload recording methodology for all of radiology.

g. To ensure diagnostic accuracy, radiology departments must maintain and perform proper quality assurance procedures (e.g., quality reviews, including access to experts as well as earlier diagnosis). The work group chose to analyze diagnostic accuracy from the standpoint of medical malpractice claims. The Department of Legal Medicine maintains a database of military medical malpractice cases, including the allegations and case outcomes. The records indicate that, in the 1990s, \$15,900,000 has been paid for claims related to radiology services. These claims are identified by specialty code "S," which is indicative of a radiologist or clinical service code DCA or DCB, indicating diagnostic or therapeutic radiology, respectively. Assuming that this is only 60 percent of the actual cases, radiology is likely responsible for approximately \$26,500,000 in malpractice claims. Of the claims identified, 91 percent of the dollar value (\$24,100,000) has been for diagnosis-related allegations. Sixteen percent of these (\$3,860,000) have resulted from a delay in diagnosis. The work group believes that in the future there should be no claims attributable to a delay in diagnosis. Although they would like to eliminate all radiology malpractice claims, they have realistically set a target of a 50 percent reduction in the number and dollar value of other diagnosis-related claims.

h. Two sources were identified that specify the appropriate staffing levels for a given level of radiology workload.

(1) One, the *Joint Healthcare Manpower Standards Development Study*, was developed by the JHMET in August 1994.

(2) The other, *Productivity of Radiologists: Estimates Based on Analysis of Relative Values Units*, was developed by the ACR in December 1991.

Both publication sources provide guidelines that specify the number of radiologists required for a range of total procedures and weighted workload. Both studies report

consistent findings. The DOD has switched to the Medicare reimbursement CPT methodology for capture and reporting of workload data. Unfortunately, the RVUs previously reported in MEPRS are not the same as the Health Care Financing Administration RVUs reported using the CPT system. Accordingly, the work group chose to analyze raw procedures per radiologist (as opposed to weighted workload RVUs), as raw procedure counts provide a relatively stable measurement from year to year. Although variations in the complexity of workload may exist at a particular site, the overall case mix throughout the DOD will vary only slightly. According to the JHMET study, there should be one radiologist for every 12,356 procedures performed at a non-GME facility. A GME facility should have one radiologist for every 7,919 procedures performed. Workload data for 1995 from the MEPRS summary system and FTE data from the Defense Medical Information System (DMIS) summary indicate that non-GME sites currently perform 14,815 procedures per radiologist and the GME sites perform 8,803 procedures per radiologist. These data indicate that military radiologists on average exceed workload targets and that the DOD is understaffed for radiology services. This represents another force for change identified by the work group.

i. The *Joint Healthcare Manpower Standards Development Study*, August 1994, estimated that approximately six technologist and support staff personnel should be available for every radiologist within a department. For facilities without a radiologist, one technologist is required for every 1,500 procedures. According to the radiology data collection survey and the DMIS summary, military radiology departments had on average 5.3 and 6.4 technologists and support staff, respectively, for every radiologist in 1995. Most sites are close to the established JHMET standard. The radiology work group predicts that changes in radiological technology will reduce the required support personnel. The work group has set the 10-year target at 4.5 technologist and support personnel for every radiologist.

j. Report turnaround time is the time that elapses between the execution of a radiology procedure and the availability of a transcribed report. Often clinicians spend days or even weeks waiting for the written interpretation before rendering a decision regarding the delivery of health services to a given patient. As reported in the radiology data collection survey, it takes 2.5 days, on average, before a transcribed report is available. The radiology work group has set 1 hour as a 10-year target for this measure. Reducing this time can significantly improve the quality of care.

k. The radiology data collection survey requested that each site obtain a random sample of 50 exams obtained within the last year. Of those 50 exams, the sites reported the number of films that were unavailable. A film may be unavailable because it is checked out by a clinician, improperly filed, or lost. Sites were also asked to specify how many of the images were unaccountable (the location of the film was not known). Of the surveyed sites, 7.3 percent of the images, on average, were unavailable, and 2.9 percent were unaccountable. These figures are greater at large medical centers where the greatest number of procedures is performed. In a survey of 100 consecutive requests at the Naval Medical Center, San Diego, CA, more than 20 percent of requested films were either lost or unavailable. Lost films are another factor in medical malpractice lawsuits faced by radiology departments. In addition, availability and accountability of radiology images and reports affect the timeliness and quality of care. The work group believes that the appropriate target should be at least 99.9 percent availability and accountability of images.

l. To be the provider of choice for MHS beneficiaries, the work group believes radiology services must be provided in a timely fashion. If military radiology services cannot be provided within the same time frame as civilian healthcare sources, business

will be lost to civilian contracts. Radiology sites reported from CHCS the number of days until the next available outpatient appointment for each of the radiology modalities. An attempt was made to obtain similar data for civilian hospitals from the ACR. The data were not available. Instead, several Northern Virginia hospitals were called with the intent of scheduling an appointment for each radiology modality.

m. The surveyed sites that have CHCS available were asked to query this database for the number of radiology procedures performed during a 2-month period. Of those procedures, they were asked to identify how many that CHCS indicated as never having been interpreted. On average, 4.4 percent of the studies were never diagnosed. Some large hospitals exceeded a 20 percent unread exam rate. The radiology work group contends that if proper utilization is taking place, all radiology studies should be interpreted with a transcribed report. They have set as a 6-year target that all studies be interpreted.

n. Early results from the pre-MDIS installation study indicate that clinicians typically spend 2 to 5 minutes each time they search for an image file. These findings are reflective of smaller hospitals and clinics where exam counts and file rooms are smaller. At larger medical centers, it is estimated that 20 minutes elapse from the time a request is made at the front desk until the film is handed to the requester. Greater than 20 percent of those searching for films left without them according to a survey at San Diego Naval Medical Center. This time spent retrieving films can amount to several hours a week for high-use areas such as the pulmonary and orthopedic sections. The work group anticipates significant reductions in fetch time with the implementation of digital technologies. Electronic storage will likely enable access to any locally stored image within 2 to 3 seconds.

o. Film-based analog radiology does not provide a mechanism to monitor the degree and amount of radiation to which a patient is exposed; therefore, there is no baseline for radiation exposure. Digital systems provide the capability to capture the amount of radiation exposure for each exam. The work group believes a baseline measurement should be established for each exam and in the aggregate for each patient as digital imaging is implemented within the DOD. This would enhance the quality of healthcare by giving practitioners the ability to determine and avoid dangerous levels of exposure. This performance measure needs to be captured, monitored, and standardized for the various imaging modalities and exam types. The ACR guidelines previously discussed provide standards with respect to the levels of radiation not to be exceeded for the various exams. As a target, the work group suggests that radiation exposures be reduced by the equivalent reduction in the number of technical repeats.

p. Repeat films are the number of films of any given examination deemed to be of non-diagnostic quality. Among other things, this could include underexposure, overexposure, poor patient position, processing error, or equipment error. According to the surveyed sites, approximately 4.3 percent of radiology exposures are repeated because of one or more of these errors. This error figure is commonly in the 10 percent to 12 percent range for teaching facilities. Digital radiology should eliminate almost all repeat films attributable to the exposure or processing errors, which constitute most repeat films. They set 1 percent or less as a target for repeat examinations.

q. Lack of expert diagnosis in deployed military situations often requires that people or films be transported to ensure high-quality care. When this happens, an individual may be lost from service unnecessarily. In addition, it is a time-consuming and expensive process. A goal of military radiology is to eliminate all medical evacuations that occur because of the need for a radiological diagnosis. If the results of a diagnosis are

positive, evacuation for health reasons is acceptable. The work group wants to avoid situations in which an individual is evacuated solely for radiological diagnosis. They also want to avoid the situation where the lack of availability of an appropriate diagnosis precludes the timely evacuation of patients from remote or deployed locations. This situation directly impacts the timeliness and quality of care received.